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Announcements by the Council.

CANTOR LECTURES.

The Second Course of Cantor Lectures will be "On the Applications of Geology to the Arts and Manufactures," by Professor D. T. ANSTED, M.A., F.R.S., and will be delivered on Monday evenings, at Eight o'clock, as follows:—

FEB. 6TH.—LECTURE 1.—On the Formation of Natural Soils by Derivation from Rocks, and on the Improvement of Soils by the admixture of Minerals.

FEB. 13TH.—LECTURE 2.—On Natural and Artificial Springs, and on the various Sources of Water Supply for Towns and Cities, in connection with the Geological Structure of the Vicinity.

FEB. 20TH.—LECTURE 3.—On Mineral Materials used for the Purposes of Construction: Plastic and Incoherent Materials (Clays and Sands).

FEB. 27TH.—LECTURE 4.—On Mineral Materials (*continued*): Building Stones and Slates, and their Relative Value under given Circumstances of Exposure, and on Methods of Quarrying.

MARCH 6TH.—LECTURE 5.—On Stratified Deposits of Minerals, as Coal and Iron Ore, usually obtained by Mining Operations, and on Mining Methods for such Deposits.

MARCH 13TH.—LECTURE 6.—On Metalliferous Veins or Lodes and their Contents, and on the Extraction of Metalliferous Minerals from Lodes.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting ONE Friend to each Lecture. For this purpose a set of Tickets has been sent to every member.

FINAL EXAMINATIONS—BOTANY.

In addition to the Prizes in this subject offered by the Society of Arts to candidates taking a Certificate of the First Class, the Royal Horticultural Society offers five prizes, of £5, £4, £3, £2, and £1 respectively, to the five candidates being gardeners by profession, who, taking any grade of certificate in Botany, obtain the highest number of marks in that subject at the Final Examinations in April next.

ORDINARY MEETINGS.

Wednesday Evenings at 8 o'clock.

FEB. 8.—Adjourned discussion on Mr. J. C. Morton's paper "On London Sewage from the Agricultural Point of View."

FEB. 15.—"On the Claims of Authors and Inventors to Property in and Protection for Designs and Inventions first published at Industrial Exhibitions." By THOMAS WEBSTER, Esq., F.R.S.

Proceedings of the Society.

CANTOR LECTURES.

FIFTH LECTURE.—MONDAY, JAN. 30.

Mr. WATERHOUSE HAWKINS delivered the fifth and last of his course, on the "Reproduction of Natural Forms by Art and Manufactures," the subject of this fifth lecture being Ceramic Manufacture, with the influence of the material on the design, and its successful production, modern terra cotta, Della Robbia ware, Majolica, Palissy ware, and Parian. The metal casting (which at the conclusion of the previous lecture was not completed in time) was exhibited to the audience. The metal having been poured, the sand mould was knocked off, and the cast of an animal in bronze metal was shown, with "gets" or channels through which the molten metal had passed. The moulds for metal casting, being made of sand, were soft and destructible, so that a fresh mould had to be made for each cast, whereas the moulds for ceramic wares were hard, and the cast was drawn from them in a semi-plastic state. Figures in metal might be cast whole, whereas figures in ceramic material were cast in many pieces from separate moulds. Ceramic or pottery wares were amongst some of the most ancient art-works of man. In the days of the ancients, Homer, while on his travels, came to a pottery; the potters being (as were all Greeks), enthusiastic admirers of poetry, bargained with Homer to give him one of their finest vases as a recompense if he would recite to them some verses

in honour of their art. This the sublime poet thought it not beneath him to do; he sang in praise of their art for, though blind, he could appreciate the beauty of form in their wares. In modern days, not many months ago, the classic eloquence of the Chancellor of the Exchequer, Mr. Gladstone, was called forth by the beauties of pottery and its artistic decoration. In speaking of majolica, we must call to mind the name of Raphael, who thought it not a condescension to devote his talents to the decoration of porcelain, but though his works in majolica were so admirable, the drawing so free and bold, untrammelled by an excess of finish or of colouring, yet the style of majolica was not so faultless as to be copied implicitly in the present day. The entire covering of an object of utility with a picture was not legitimate decoration. When a dessert plate, for instance, was entirely covered with a picture, it could not be used without so disfiguring it with the juice of fruit that it was no longer possible to appreciate its artistic beauties. With regard to the ware termed *Della Robbia*, it consisted of sculptured figures in clay covered with a coloured glaze; and in that known as Palissy ware—the most perfect reproduction of animal forms in pottery—the fish and reptiles in the centre of a dish or plate for soup, were at the time they were made regarded as practical jokes, and so life-like did the great artist, who was also a profound naturalist, make these reproductions, that when covered by a transparent fluid soup the delusion was complete; but now that the idea of their reality was not entertained, the copies and imitations of Palissy ware were of no avail, except as gratifying illustrations of the fact that whatever had been done in ceramic could now be repeated by our enterprising manufacturers. After mentioning the distinguished names of Wedgwood and Minton, of our own time, Mr. Hawkins recurred to the loss which manufacturers had sustained within the last few weeks by the death of Mr. Thomas Battam, who, by the union of practical knowledge with artistic skill and feeling, had done so much for ceramics, more especially for Parian. Mr. Hawkins next spoke of terra-cotta, which, by reason of its durability, afforded so many facilities for out-door decoration. Terra-cotta was first successfully manfactured in this country between the years 1790 and 1800, this enterprise being commenced by a lady of the name of Coade, at Lambeth, but it was for a time superseded by cement. In 1845, the manufacture was again revived by Pulham, of Broxbourne, and by Blanchard and Blashfield, of London. Terra-cotta presented so many advantages in its susceptibility of undercutting and relief after moulding and previous to fixing, and also in its suitability to our climate, being more durable and less affected by weather than even the best stone, that it was a subject for regret that our artists did not make more use of it. There was also another use to which it had been put, viz., as a material for portrait busts. In the South Kensington Museum there were several beautiful ancient busts in terra-cotta; and Mr. Hawkins showed his audience a plaster cast of a terra-cotta bust of Shakespeare, by Roubillac, which was discovered in the pulling down of a building in Lincoln's-inn. It was broken into pieces by the workmen, but after having been re-united by Mr. Clift, was moulded and cast by Mr. Hawkins, while engaged in his great works at the Crystal Palace. This bust presented many difficulties in moulding by reason of the deep undercuts, it being evidently the hand work of the artist, having never been intended for multiplication by casting, and hence the complications in which the modeller had indulged. "Modelling" for terra-cotta might more appropriately be termed carving, for modelling might be defined as putting on what was required, but carving was taking off from the surface and leaving what was required. If the artist, in providing a work for terra-cotta or any other ceramic ware, thoughtlessly added a piece of clay, according to the ordinary process of modelling, that piece would, in the firing, crack or come off. It was therefore a necessary condition for all works leaving the artist's hand direct for the fire that the mass be homogeneous. Works in terra-cotta when moulded, were also divided into pieces for firing, like other ceramic works; the arms, for instance, of a figure were cut off, and the lower limbs also; the artist therefore must, in making a design, take this condition of the material into consideration, and by armlets on the arms, or by the edges of the drapery, aid in the concealment of the inevitable joins. Parian presented the same difficulty, as Mr. Hawkins demonstrated by sketching on his canvass the fourteen pieces into which a small Parian group, called the "Cat's Paw," of a monkey with the cat and chesnuts, which he had himself modelled many years ago, had been cut for moulding. The complexity of the design had thus increased the labour of the moulder—adding to the expense in production. Again, another difficulty of Parian, which was shared only in a slight degree by terra-cotta, was the contraction which took place in the drying and firing of the cast. To illustrate this, Mr. Hawkins had on the table two busts of the Prince of Wales, one in plaster and the other in Parian, both cast from the same mould, though the Parian was one-fourth smaller than the plaster cast. In slender parts, such as the limbs of a figure, the contraction was of course more rapid than that which took place in the bulk of the body. To guard against the possible deformity which this would occasion, the artist had to give additional size to the slender portions, that they might be compensated for, and the contraction become of due proportion with regard to the more solid parts of the figure. These and many other difficulties in material and process, if not known by the artist, would be insuperable obstacles to the reproduction of his works, whereas, if he had a thorough practical knowledge of them, he might so adapt his designs as to facilitate the operations of the workman, and thus that happy co-operation between artist and manufacturer would be secured without which works of art could not be so multiplied and perpetuated in connection with articles of utility as to increase their commercial value, and at the same time reduce the cost of production, so that the masses of the people might become familiar with the refining influence of true art, judiciously combined with the requirements of every-day life.

At the conclusion of the lecture, Mr. HAWES, who occupied the chair, rose, and after remarking on the amount of practical knowledge as well as artistic power which Mr. Waterhouse Hawkins had displayed in his lectures, and in his graphic illustrations on the black canvass, proposed a vote of thanks, which was most heartily responded to by the audience.

NINTH ORDINARY MEETING.

Wednesday, February 1st, 1865; EDWIN CHADWICK, Esq., C.B., in the chair.

The following candidates were proposed for election as members of the Society:—

Cockel, George, 77, Onslow-square, S.W.
Creswick, J. Frost, 8, Bloomsbury-square, W.C.
Evans, George, Newton Heath, Manchester.
Kirkman, C. F., 27, Claremont-terrace, Fentiman's-road, South Lambeth, S.
Mayson, J. S., Rusholme.
Morey, Samuel Dance, Ironmonger-lane, Cheapside, E.C.
Seymour, J. R. W., 23, St. Augustine-road, Camden New-town, N.W.
Telbin, William, 29, Winchester-crescent, Cheyne-walk, Chelsea, S.W.
Tetley, J. Rimington, 21, Carlton-hill, N.W.
Tonge, George, 3, Lancaster-terrace, Upper Hyde Park-gardens, W.

The following candidates were balloted for and duly elected members of the Society:—

Beloe, Chas. H., 26, Bedford-place, Russell-square, W.C.

Bishop, James, 176, Upper Thames-street, E.C.
Bowring, John, 51, St. Mary-axe, E.C.
Dean, John M., The Grove, Stratford, E.
Gibson, John, 1, Stamford-terrace, Stamford-hill, N.
How, Thomas, 29, Gloucester-place, Hyde-park, W.
Hughes, Joseph, 37, Queen-street, Ratcliff, E.
Lavey, Charles, 341, City-road, E.C.
Parker, George Bass, 25, Grove-terrace, Highgate, N., and 4, King-street, Cheapside, E.C.
Paty, General Sir George William, K.C.B., 24, Regent-street, S.W.
Peard, Thomas, 159, High Holborn, W.C.
Pendergast, John, 103, Adelaide-road, N.W.
Pike, Fred., 44, Charing-cross, S.W., and Dulwich, S.E.
Pitman, William, 210, Euston-road, N.W., and 88, Newgate-street, E.C.
Plowden, Trevor Chichell, Oriental Club, S.W.
Plucknett, George, 258, Gray's-inn-road, W.C.
Pratt, Hodgson, 8, Lancaster-terrace, Regent's-pk., N.W.
Rejlander, O. G., 129, Malden-road, N.W.
Robinson, Thomas, 260, Gray's-inn road, W.C.
Roebuck, William, 21, Ellington-st., Arundel-square, N.
Sconce, Gideon C., 48, Lincoln's-inn-fields, W.C.
Sexton, George, M.D., 63, Springfield-road, St. John's-wood, N.W.
Sharp, Henry Locker, 15, Great Cumberland-street, W.
Shaw, Maltman Wm., 24, Carlton-hill-villas, Camden-road, N.W.
Stanton, John, M.D., 9, Montagu-square, W.
States, William, 12, Prince's-street, Hanover-square, W.
Stevens, Henry, M.D., 78, Grosvenor-street, W.
Stewart, Donald, 7, Gloucester-terrace, Regent's-park, N.W.
Stuart, Charles, Manor-house, Stepney-causeway, E.
Taylor, John Henry, The Limes, Upper Holloway, N., and 15, South-street, Finsbury, E.C.
Teape, Hannaniah, 37, Trinity-square, Tower-hill, E.C.
Thomas, William, 20, Boltons, West Brompton, S.W.
Thorold, Rev. Anthony Wilson, 16, Bedford-square, W.C.
Vickers, Stanley, Hill-house, Streatham-common, S.
Waller, Edmund, 217, Brompton-road, S.W.
West, William Nowell, 30, Montague-street, Russell-square, W.C.
Whytock, Alexander, 9, George-street, Edinburgh.

AND AS HONORARY CORRESPONDING MEMBER.

Honeyman, Rev. D., D.C.L., Antigonish, Nova Scotia.

The following Institutions have been received into Union since the last announcement:—

Dean Mills (near Bolton) Institute.
Newton Heath and Failsworth Mechanics' Institution.
Rusholme Public Hall and Library.

The Paper read was—

LONDON SEWAGE FROM THE AGRICULTURAL POINT OF VIEW.

BY JOHN C. MORTON, ESQ.

I am perfectly aware that any service to be rendered by the Society this evening towards the utilization of London sewage must depend principally upon the discussion which is to follow the reading of this paper. I shall, therefore, not occupy your time for long in stating, as an introduction to this discussion, the data and conditions on which agriculture may be able to offer a solution of the difficulties which surround the subject.

Early last November, before the Metropolitan Board of Works had decided what to do, and while the public papers, stirred up by the report of Lord Robert Montagu's committee, overflowed with controversy on the sewage question, I suggested to your Secretary that advantage should be taken of the agricultural week in December, when many farmers are in town, to submit some of the schemes which had been propounded before that committee to the test of such criticism as they would have received here from an agricultural audience. The Wednesday in question had, however, already been allotted, and that is how the discussion happens to have been delayed till now, and left for me to introduce.

In this paper, then, on "London Sewage from the Agricultural point of view," I not only mean to exclude the engineering and sanitary aspects of the question, but, while discussing the merely agricultural aspect of it, I wish to confine myself and you to that view of it which it presents, not to ratepayers and enthusiasts, but to farmers. Of course everybody knows that there has been a great deal of wild enthusiasm and speculation excited by both newspapers and committees; and even agricultural journals have been "bitten." I suppose that if a sober view of the agricultural value of sewage manure were anywhere to be expected, it would have been in the columns of the *Mark Lane Express*. But what does the clever editor of that agricultural paper say? He declares that recent experiments, discussions, and discoveries have thrown so much new light upon it, and made us all so much more sanguine of a profitable issue, that an altogether new leaf in the book of agricultural progress has, in fact, been turned; and therefore, if any one shall hereafter quote any of the former leaves of this book—any or the older blue books, whether containing evidence of writings of his own or others—in any future discussion of the subject, a vat of the very richest of the stuff is to be prepared, and he is, in short, to be ducked in it.

Now having unfortunately given evidence before Dr. Brady's committee; and having, at intervals during several years, used what opportunities occurred to me of presenting the facts and stating the arguments which have year by year accumulated as the urgency of the question grew, it might thus be difficult for me to avoid the fate which my kind friend and brother editor had prepared for me. In order, therefore, both to escape the ducking, and also to give the most recent evidence of an eye-witness, avoiding all reference to blue books and other publications, I have within the last few weeks spent a day at Rugby, and another at Birmingham, a couple of days at the Craigentinny meadows near Edinburgh, and a couple of days at Croydon. Along with Mr. Harrison, M. Inst. C.E., of Forester Court, Gloucestershire, I have also spent a week in South Essex, down at the Dengie Flats, the Maplin sands, at Burnham, Foulness, Rayleigh, Stanford le-Hope, and other places, trying to find out in what relation the present circumstances of Essex agriculture stand to the subject; and we paid visits to the home farm of the Earl of Essex at Cassiobury, and to Mr. Blackburn's farm at Aldershot. And I propose to-night to tell you what I have seen and heard within the last two months at all these places.

Of course the evidence of an eye-witness accustomed to the inspection of farms and to the examination and discussion of both ordinary and extraordinary agricultural experience, who has made it his business to examine afresh in this way almost all the places where sewage is now being utilised, must be a serviceable contribution to the discussion of the general subject, provided only that it be impartial. And if it be objected, as it may, by advocates of any of the schemes for using London sewage, that anyone who has already committed himself to a particular view of the subject, before, for instance, Dr. Brady's committee, must be pronounced already prejudiced and partial, then it must be at once admitted, that an acquaintance both with agriculture and with sewage had led me long ago to a definite opinion of the right way to connect the two; and that, having formed this opinion after a previous inspection of most of the places named, it was with some confidence in its soundness that I recently examined them again.

This I presume is what is meant by prejudice. Allow me to say that there is no word used by amateurs in agricultural discussions that is more maltreated and abused Any one—I do not say a professional agricultural chemist who works almost as much in the field as in the laboratory,

but a man who takes his facts from the laboratory of the chemist, who deals with soils or with manures on filter papers, in bottles, and in crucibles, or with plants in fragments and in flower-pots, is allowed to expatiate unquestioned, and of course, we all gratefully acknowledge, often usefully upon the policy or impolicy of the various operations of the farm; but he who has witnessed and directed the operations of chemistry and life for years and over acres, who has long annually furnished the material and gathered the fruits of these operations over whole fields and farms, has his doubts or his convictions attributed to prejudice. It seems to me that if the word be properly applicable to whatever either of credulity or of dogmatism on any subject precedes experience, it can be least frequently applicable on agricultural subjects to the farmer. He at least comes to any agricultural discussion with experience to guide opinion; and he has, as I think, cleaner hands, on the score of sobriety and impartiality of judgment, than the enthusiast who charges him with prejudice because he does not believe that the profits of farming depend simply, to put it shortly, upon the atomic theory of the chemist. I at once confess that the analogy of agricultural experience, both of costs and of returns, leads me to prefer those plans for using London sewage by which it is applied to land in quantity, as in water meadows; and I have found that the experience of sewage farmers hitherto does generally sanction these plans. Still further, I may confess that, having investigated pretty fully both at Foulness, Dengie, and the Maplin sands, and through the line of country thither, the plans of Messrs. Napier and Hope for using London Sewage there, I believe them to be consistent both with ordinary agricultural experience and with that of sewage farmers generally. With this "prejudice" it was that I revisited the different places I have named; and now, finally dismissing these personal explanations, it is with this "prejudice" against me, I have to tell you what I saw and heard upon my tour.

1. First then of Rugby:—Here the washings of 8,000 people in a town which is, I understand, very fully supplied with waterclosets, are drained into a tank in the valley below, and thence continually, excepting nights and Sundays, forced by pump through several miles of underground pipage to one or other of various exits, some of them a mile away, on ground probably 60 or 70 feet above the level of the tank; and thence sometimes by hose, and elsewhere by mere surface runnels as in ordinary irrigation, the sewage is distributed, a plot or ridge at a time, over the grass land, until the whole surface of a field is overtaken. I am told £50 a year is paid to the town as rental for the manure—3s. or 4s. a day, or, including expenses of distribution and interest of capital, altogether probably some 30s. to 40s. a day for some 200,000 gallons; and I am told that none of those who rent it are satisfied with the result. Mr. Campbell, to whom a portion of the sewage is sublet, fails of a profitable result because he cannot get the sewage when he wants it, nor enough of it then. Mr. Walker, over whose land most of it is poured, is dissatisfied because of the injured quality of his pasture land, where it has been applied in large quantities. I have seen here heavy and early crops of Italian rye-grass, at least 10 tons per acre, in the month of April, grown on rather unkind land, chiefly by the aid of sewage; and we all know, from the published reports of the experiments superintended by Mr. Lawes, that the produce of the ordinary grass fields upon the lias clay land here has been wonderfully increased by the use of sewage, and nearly in direct proportion to the quantity applied. But it is worth noting that although the manure is here put upon the land at the cost of less than ½d. per ton, and not much more than 1s. per head per annum of the population who supply it, I did not meet with any one who was satisfied that it was agriculturally profitable. Let me mention here two other noteworthy things:—I saw coarse, couchy, weedy-looking stubble of grass, originally, I was told, good grazing ground, which had been sewaged, and which after various mowings had latterly kept an enormous stock on it for some weeks to eat it down. This land had been lately valued for the purposes of ordinary agriculture as having been injured in selling value to the extent, I think, of £20 an acre, by being sewaged. And I saw good grazing land, which had been also sewaged, and was being sewaged when I walked over it—as full of clover and sweet short grass, and as abundantly producing first-class feed as any pasture I was ever over. Both had been sewaged—the one had been mown, and mown, and mown—and the other had been fed, and fed, and fed; the latter kept firm by the treading, and also no doubt replenished by the droppings of the cattle which lay thickly on the ground, had retained the original quality of the grass; which is generally, and at Rugby also as I have said, injured by the sewage irrigation where only mown crops are taken. As to the valuation of the land for ordinary agricultural purposes after a year or two of sewage, it is plain that any figures so obtained must be taken according to their strict meaning. The agricultural valuation of land must be made absolutely, and not for any special purpose, in order to learn whether any profit or loss has been sustained.

2. At Birmingham, the sewers which drain the two valleys over which the houses of 300,000 people are here distributed unite in tanks at the confluence of these valleys, for the settlement and deposit of their mud before the comparatively clear water is allowed to flow into the natural stream again. Some thirty acres of land have been here purchased by the corporation, and this mud is pumped by Walker's diaphragm pump to one and another section of this acreage, and as it dries it is dug out and carried away. This is creating such a nuisance, that at length they are pumping the sediment into barges on the canal within a few hundred yards of the tanks, and taking it to the various farms along the canal; in neither case however does the value received repay the costs connected with the process. In the meantime the soluble and valuable part of Birmingham sewage is going down the river as before. And as the water-closet system extends, both the nuisance of the tanks and the wastefulness of the overflow from them will increase.

The level lands near the tanks are occasionally flooded from the sewers as they were formerly from the river, and with about the same effect as formerly, according to the tenant, who denies the right of the corporation to charge a rent upon him for this water, which is, he alleges, no stronger than the original foul river water.

But it is flat land, and occasionally the water lying on the land has killed the grass instead of benefiting it. This is a contingency which may, I suppose, be occasionally looked for from the washings of a manufacturing town. It will be quoted by the advocates of scanty dressings as a risk to which those who use large quantities are especially liable. It appears to me to have been due to the flat surface, on which, with its imperfect surface drainage, the water must occasionally stagnate. Mr. Councillor Walker is urging the distribution of the overflow of the sewage tanks here, and declares that their 20,000,000 tons of it would, at even ½d. a ton, yield a monstrous revenue beyond the cost of distribution. It seems to me that here is an example of a central delivery of a great town drainage, where the water-closet system must be rapidly extending, which is ready for being turned immediately to agricultural account. It is however fair to mention, that several of the leading medical men in Birmingham recommend cutting off a portion of the supplies from the sewers immediately below the water-closets. Both Dr. Bell Fletcher and Mr. Chesshire, recommend contrivances by which much is retained, as in portable closed cesspools, for collection at monthly or half-yearly intervals by night carts as formerly. And this practice, if it should extend, would to some extent diminish the value of the waste.

3. We now come to the Edinburgh meadows. The

principal facts are that at Lochend and Craigentinny on the north-east, at Grange upon the south, and Dalry upon the west, there are some 350 to 400 acres of grass land, over which the filthy natural drainage of the town is poured as in ordinary water meadows. The lands are generally sloping, so as to enable a rapid flow, and the streams which wash out the valleys over which Edinburgh is spread, receiving the drainage of its houses, are of sufficient volume, when supplemented by the artificial water supply of the city which drains into them, to give an abundant irrigation to the land. From 10,000 to 20,000 tons per acre annually are thus distributed, in one or two floodings during every interval between the cuttings of the grass, of which three, four, and more rarely five, are taken in the course of the season. Perhaps the best illustration of the productiveness and value of the grass thus treated is furnished by the fact that there are about 2,000 cows in and around Edinburgh and Leith fed from these meadows during summer, or nearly six to every acre; and that between the middle of April and the end of October, they will on an average consume from 80 lbs. to 120 lbs. a day apiece, along with about half a bushel daily of spent malt from the distilleries. If the consumption of these cows be put down for 180 days at 100 lbs. apiece, the produce of the acre which keeps six of them must be close on 50 tons a year, and for this the average price paid is £23 to £25, or about 10s. a ton as it grows. I learned from a very intelligent man, who keeps 24 cows in Leith, that he has usually purchased at the spring auctions, when the year's growth is sold, 4 acres for his 24 cows, paying about £100 for them; and this perfectly tallies with the average result already given.

Some of the plots, they say (the grass is let or sold by auction for the year in acre and half-acre plots) are let or sold for as high as £40 the imperial acre, but the average price is £23 to £25 per acre. The worst pieces are the flattest and undrained, which are thus incapable of getting a rapid flow either over or through the land. The best pieces are those which face the south, which have a sufficient slope to permit a rapid flow of the sewage over the surface, and which are of so open a texture as to permit a good natural drainage through the land. It is worth noting too that while the inferior bits have by drainage been improved in productiveness, the best bits always remain the best; it is always particular spots, especially those which, owing to aspect, soil, and abundant supply of irrigation, are earliest ready for the scythe, that command the exceptional prices which are sometimes quoted by enthusiasts as if they were the average yield of the meadows. The early grass is worth to a milkman as much as 1s. per cwt. to go to the field and cut it for himself, although the average throughout the year is not worth much more than 6d., and that is how those early pieces fetch so long a price. It must also be understood that while grass—milk being 10d. a gallon in the Edinburgh trade—is worth 6d. a cwt. or more, perhaps, upon an average, to the cowkeeper to cut and carry a mile, or even two or three, yet it is not worth so much for any other purpose. It will answer for feeding neither cattle, sheep, nor horses; and thus it is that it is just in proportion to the demand there is for it for cows that the price is maintained or not. The prices named were as high twenty years ago as now. There were one-third fewer cows then than now, but there were just about one-third fewer acres then as well. As the demand increased and prices rose, more acres have been added. Italian rye-grass, broken up every third year and re-sown after taking a potato crop, has been grown at Lochend, and lying above the natural fall of the stream, it is watered by a self-acting pump driven by the stream itself; and fetches nearly the average price, although it does not reach the maximum achieved upon the best bits of natural grasses.

At Dalry, too, and the Grange, natural grasses, chiefly rye-grass, have been sown along with, in places, top-dressings of chopped couch, and watered by the foul stream, and equal productiveness has been soon acquired for newly laid down pieces. Whatever grasses are sown originally, *Poa trivialis*, *Alopecurus geniculatus*, and *Glyceria fluitans*, with couch grass, crowfoot, and other weeds, and, where the land is best drained and dryest, rye-grass, catstail, cocksfoot, &c., ultimately form the pasture. And it would be pronounced by any one as I saw it last month, a wonderfully thick and luxuriant grassy surface, nothing like so coarse and weedy generally as the Rugby meadow, to which I have before referred.

At Craigentinny, too, the meadows have been added to occasionally, and pumping engines have been erected to extend the limits of the area commanded by the stream; but they are no longer used, for it has been found here more than once that if but few acres in excess of the demand are brought into the market, the average price of the whole at once drops. I cannot too strongly impress upon promoters of schemes for utilising London sewage, that this is a very important part indeed of the Edinburgh experience for them to read—350 to 400 acres of this sewaged grass suffice for 2,000 cows. The people of Edinburgh and Leith are far better supplied with milk than those of London; but even there there is but one cow to every 100 of the population. And the 30,000 cows required at this rate by the metropolis would all be fed during summer, according to the Edinburgh rate, on 5,000 acres of grass. If there be any considerable increase in the supply of grass here beyond the Edinburgh rate, then it is plain from the Edinburgh experience that the Edinburgh prices will not be realised. Probably, the chief way out of this difficulty may be to copy Lochend in growing Italian rye-grass, for which there is a demand other than that of cow-keepers; but I cannot doubt that the marketing of the enormous grass produce which we shall obtain from London sewage will for many years be the greatest difficulty in the way of a profitable result.

Without discussing here, in detail, the quantity of sewage to which the Edinburgh results are owing, it may be said that the drainage of an area covered by more than 100,000 people is spread over 350 or 400 acres (we cannot, of course, infer from this that the waste from all these people reaches the land); that six to ten floodings are given during the growing season, besides, in the lowest lands, heavy floodings in the winter time—that the duration of the application varies from 4 to 40 hours at a time, and that the quantity applied varies from 10 to 20 thousand tons or more per acre in the year—that the grass produced is 45 to 50 tons per acre, capable of feeding 6 cows during the summer half-year; and that it is bought by men who are at all the expense of cutting it and carrying it home themselves for £23 to £25 per acre on an average, exceeding £35 and even £40 per acre in particular and exceptional plots. It may be also said that much of the land yielding nearly the average price is the poorest seaside sand; and that a great deal of it, watered with tail water which has already gone over land above, is just as good as the rest. It is all mowed and mowed, the produce being carried wholly away, and it maintains its productiveness year by year under this abundant sewage irrigation, notwithstanding this immense draught upon its resources. One fact more of great importance,—the poor, sandy land, notwithstanding the immense supplies of manure, is not enriched; a grain crop following the heaviest crop of grass, being unmanured, has failed; the potatoes following the Italian rye-grass at Lochend require to be most liberally manured. The Italian rye-grass following last year's manured potatoes, sown in August and September, was looking splendidly last month at Lochend, and dressed as it will soon be with sewage, it will be worth, perhaps, £20 an acre during the coming summer. In 1866 it may be worth as much, but this growth and value is wholly owing to the supply month by month of the manure, not at all to the land, which is no richer at the end of all this manuring than it was at the beginning.

So much for the Edinburgh meadows. If the net gross proceeds of the land be put down as £8,000, there is

probably as much as 2s. a head obtained from so many of the population as contribute to the result, and diluted as it is (much of it, too, used twice), I do not suppose that more than ¾d. per ton is obtained from the sewage. The Edinburgh results are obtained from the use of very dilute and already putrifying sewage in large quantities over slopes of light and well-drained land. And poor though they be as compared with the results and definitions of analysis, they are the most profitable results that have yet been anywhere obtained.

4. Compare them with those on farms near London.

(*a*) Near Croydon, Mr. Marriage deals with the sewage of 20,000 people, in a stream of 1,000,000 gallons daily, over an extent of about 250 acres. He uses the water a second or third time. His fields vary from 300 to 500 yards long. The feeders are 15 yards apart, and the "panes" or beds between them sink transversely at once from these parallel feeders across the breadth of them; and they sink, on the whole, in the length of them, about 1 in 400. There are no intervening drains, but any cubic inch of sewage may leave the feeder at the upper end, and, if not previously absorbed by the gravel subsoil, may trickle over the whole length of the bed to the transverse drain across it, 400 yards off; or it may leave the feeder 10 yards from the end, trickling only 10 or 15 yards to the drain close by. A very close and thick growth of grass, with clover appearing in the autumn, exists in the upper fields of natural pasture, which has come of itself after the Italian rye-grass without any direct sowing of seed, when the latter had died out, as it gradually does, after the second or third year. Italian rye-grass is sown in autumn, and keeps down two or three years, and is then broken up for mangel-wurzel and followed by potatoes, and then is sown down again. A cutting of 10 or 12 tons of grass in May is followed by others of about 7, 4, and 3 or 4 respectively, so that upwards of 20 and up to 25 tons of green food are got for sale. This, however, is certainly less than might be expected. Mr. Marriage declares that there is no good derived from drainage; mere surface feeding as it flows is depended on; but the gravel subsoil here does supply a natural drainage to a certain extent, and the ditches are deep enough to take advantage of it. Land in the neighbourhood, and this land before sewaging, was worth £2 an acre; Mr. Marriage pays £5 and seemed in good spirits. He gets, I believe, upwards of 20s. a ton for grass in town 10 miles off, and 12s. to 14s. a ton for it on the ground, his own men mowing it and weighing it. Sewage helps the early growth amazingly. It is common to put it on twice between the cuttings, the intervals being five or six weeks, and the latter of the two dressings being often among the tall grass, when it is quite as efficient as elsewhere. It is put on for 30 hours at a time. The main facts are that the sewage all goes on filthy, and leaves the farm clean and limpid; and mixing up Mr. Marriage's plans for the future with his experience in the past, we may believe that it will leave behind it on the 250 acres available for it the following produce:—150 acres of Italian rye-grass at 20 tons = 3,000 tons at 12s. = £1,800; 50 acres of mangel wurzel at 20 tons = 1,000 tons at 20s. = £1,000; 50 acres of potatoes at 6 tons = 300 tons at 70s. = £1,050 = in all (under a rotation of three years, Italian rye-grass, mangel-wurzel, and potatoes) £3,850, or about £15 per acre. It is plain that this sum may be largely raised by an increase in the quantity of the Italian rye-grass; and this, I cannot doubt, must be obtainable. It is only gradually that a market has been obtained for the grass. At first there was considerable difficulty and some hay-making. Now there is a constant demand, but only an uneven supply. The second and third cuttings last year suffered from the drought, and under a hot summer sun it seemed that the tendency of the grass to throw up its seed-stem was unconquerable.

(*b*) At Cassiobury, the experience of the Earl of Essex, which is longer than that realised at Croydon, may be also named. There is here, from Watford, the sewage of 4,000 people, and 200 acres of land were provided with pipage to receive it; but I understand that his lordship has learned by experience of its comparatively small value in small quantities, to apply the whole of it over only 7 or 8 acres of Italian rye-grass during summer, cutting 30 or 40 tons per acre annually, and throwing it over 30 to 40 acres of his park land during winter.

(*c*) Mention must be made of the Camp Farm, Aldershot. 10,000 to 12,000 men use the latrines. These are flooded and flushed out at regular intervals, and the whole of the stuff is to come through 18-inch pipes of earthenware down to Mr. Blackburn's farm. This is 160 acres of poor gravelly, sandy, heathery waste. The subject here is only in estimate and anticipation as yet, although Mr. Blackburn has had experience elsewhere, by which he is guided both as to plans and expectations. Some of the stuff will *flow* over part of this land, and that part will always be available for the overflow of any remainder, which is undelivered by the pumping apparatus. Mr. Blackburn will pump by underground pipes to the centre of every five acres, and thence deliver through surface-pipes on wheels, to the centre of every 1½ acre, and thence by hose. A man will thus deliver, it is said, 400 tons a day, and 200 tons are expected to be a dressing for an acre. Drainage is obtained naturally through a gravel subsoil, and it is intended that none of the sewage shall flow off the surface; it shall all be used in the deepened soil, and it shall all be used on a minimum quantity of land in the first place, until that is got up to the right standard of fertility, and then the work will be extended. Italian rye-grass will be followed every third year by potatoes. Sixty tons per acre of the grass is the produce to be aimed at, and some 20 acres only are in the meantime being prepared. The plan here is to put the sewage on before it has time to rot, and to use it by hose and jet at the rate of 200 to 400 tons to a cutting. There is a quantity of water in land springs available, and useful for irrigation; but ordinary surface irrigation is not the plan advocated by Mr. Blackburn; he holds that only as a second resource. It is with pipe and hose, and with an economical use of the fresh material, that he declares to win.

It is plain that Mr. Blackburn's plans are directly opposed to those which have been productive of the Edinburgh result, which is due to irrigation in quantity with dilute and putrid sewage, and to a feeding not of the soil but of the plant.

These, then, are the facts, wholly agricultural—for I have not referred to the chemistry of the subject at all—on which the agricultural view of London sewage depends. The sewage of London differs from that of Rugby, Edinburgh, and Croydon in quantity alone. In every case there are from 40 to 60 tons of water to the annual waste of every individual of the population. In every case, as water-closets come more generally into operation, this filthy water will become more fertilising. Meanwhile, the actual agricultural experience elsewhere surely is the proper guide for estimate and foresight here. If we had 15,000 to 20,000 acres of light and sandy slopes below the present outfall of the sewers, this agricultural experience would point at once to a very easy solution of the problem. Failing these, Messrs. Napier and Hope propose to pump the whole of North London sewage (100,000,000 tons per annum) 50 or 60 feet, and let it flow along a culvert down to Foulness and the Maplin sands, where some thousands of acres, partly perhaps by purchase and partly by embankment from the sea, can be obtained, over which it may be poured, and there produce the 40 to 50 tons of grass per acre which are got at Craigentinny. This will be the almost immediate result; and thereafter year by year, on the farms along the course of the culvert, it is believed a demand for sewage will gradually arise to supplement the deficiencies of Essex agriculture. I suppose that in the immediate opportunity which is thus afforded of using all the sewage at the very outset, whether or not in an outrageously extravagant and wasteful way, as some people think (at all events very

much after the way in which Craigentinny is at present managed), combining with this the scope which is afforded for the gradual extension of a more economical and considerate use of the sewage all through the lower part of Essex, on its way to the final outfall, this scheme has the advantage of its rivals. It certainly has the sanction of the agricultural view of the subject which Rugby, Edinburgh, Croydon, and Cassiobury present; and while Aldershot, with its proposed economy of the material, is still a problem, yet, if that should succeed, it too may be copied easily and perfectly.

I propose now to devote the short remainder of this paper to a consideration of the scope which Essex agriculture, on the one hand along the line of the culvert, and the Maplin Sands on the other, at the termination of the culvert, offers for the use of London sewage.

The Maplin Sands, a considerable width of which it is proposed to embank, are a uniform slope of sheer sand, not sufficiently inclined for catch-water irrigation, but sloped probably enough for the ridge line feeders of "lands" extending seawards at right angles from the shore; which lands might be laid out with sides sufficiently steep and with intervening drains also having fall enough; and several series of such lands, 300 or 400 yards long apiece, all pointing seawards, might be laid out in the breadth reclaimed; the cross main-drains of the first series collecting the water used there for a second use over the third series, and the tail water of the second series being used upon the fourth, and so on. The island of Foulness, on the side next the sand, all below high-water mark, is a comparatively light soil, and in places shallow, upon a sandy subsoil, quite suitable for irrigation, and capable of being laid out for it without much expense.

Excepting about Rochford and the Wakerings, and again over a tract near Stanford-le-Hope, where the soil is more or less free and light over gravel, the land all along South Essex, westward from Foulness, is a stiff clay soil. Most of it is arable—a proof of dry climate. Anywhere else than Essex such land would be in pasture, and if ever the rainfall be supplemented by even so small a quantity as 12 to 20 inches of sewage annually, it must be pasture here. Such stiff clay would be utterly unmanageable as plough land if frequently soaked either naturally or artificially. The drainage of the country is almost wholly a surface drainage: narrow ridges, the width of harrow, drill, &c., are worked by horses walking in the furrows, and these furrows are immediately cleaned out by a plough following the sowing machine, and they are then connected by cross-cut furrows cleaned out by hand where necessary. Steam cultivation has been adopted in places, and probably deep draining will succeed after it. It is wheat and bean land, with occasional vetches and fallow; straw is sold into London and dung brought back at about the cost of the straw. The whole country is London-clay and arable, growing corn and straw for sale, and buying dung. There is hardly any stock to be seen. And on Foulness the sales of straw to the bargemen and purchases of manure from the bargemen about balance each other in the year.

It seems to me that in the barren slope of worthless sand at one end of the line, in the immense scope which exists for an extension of the milk supply, of which I hope we shall hear something more this evening, at the other end of the line, and in the existence of an extensive tract of arable land without stock, whose straw is at present sent 20, 30, and 40 miles, manure being brought back as far, we have all the elements required for the profitable conversion of 100,000,000 tons per annum of North London sewage.

At the outset probably the demand for sewage along the line must not be counted on. But, then, these sands come into use. In the outset, too, we shall probably be over-stocked with the produce of the grass sown there; and hay-making may be required. Of course it is impossible to make 30 or 40 tons of grass per acre into hay while the sun shines upon the land which grows so much. But I think it may be possible to make it artificially. Twenty-five tons of well-grown Italian rye-grass, which may make only £12 or £13 as green food, will yield probably 5 tons of hay, worth at least £20. In the manufacture of this quantity 20 tons of water must be driven off, and if this can be done for £6 or £7, there will be a profit on the process. The grass might pass downwards by zigzag travelling open bands or shakers, from the top of a shaft or building to which it had been lifted, and might during its passage downwards be subjected to a current of hot dry air upwards, so as to come out dry enough to stack; or it might be taken slowly along a long horizontal shaft, and subjected to the same influence, entering it green and emerging dry. There does not seem any difficulty on the face of it in thus dealing with that large surplus of green grass, which will certainly in the first instance be on hand. And if 6 or 7 tons of hay per acre are thus obtainable, the revenue should be even larger than if a direct sale were had for grass at 10s. a ton.

The books tell us that 6 to 10 grains of water would be taken up in every 100 cubic inches of space, raised from say 60° to 180° or 200°, even supposing it saturated at the lower temperature. To take up 20 tons of water in this way then, we should need a space equal to from two to three millions of cubic feet, and raise its temperature from 60° to 180° or 200°, and keep it (or, what is the same thing, keep so much air) at that temperature while it was passing through a shaft or passage for long enough to get saturated at the higher temperature from the moisture of the green grass as that was being brought along the passage. Can such a shaft or passage, say 4 feet deep and 10 feet wide, be kept at the temperature in question, and have air heated to that temperature driven along it at the rate of about 800 yards an hour for 24 hours, by the consumption of say five tons of coal? If it can, then hay can be artificially made at a profit. And although the sewaged natural grass makes soft and worthless hay, that from Italian rye-grass is perfectly good. The conversion of the green grass into hay, is a change from goods for which there is insufficient market, and which will spoil if not immediately used, to goods for which there is always a demand, and which can be stored. And believing, as I do, that the immediate effect of any great extension, in the neighbourhood of London, of such an experience as that of Lochend or Craigentinny, or even that of Croydon (the only profitable examples by the way which we have to follow) would at once glut the market, and altogether overflow the demand for its produce, I feel certain that this question of artificial hay-making is of great importance.

Whatever the scheme adopted, there is no difficulty either on the score of engineering, or, where the abundant method of irrigation is adopted, on the score of the chemistry and composition of the material, to be anticipated. Neither is there any difficulty in the agricultural aspect of it, so far as the certainty of a crop is concerned; but I believe that during the first years of our agricultural experience of it, we shall be puzzled by a plethora of produce, for which there will be an insufficient market. It will be some time before the cow-keeping business will be transplanted from the grooves in which both food and trade have run so long, down to a new region, though it be of food so much more cheap and plentiful, and the question of artificial haymaking will have considerable importance during the period of change.

There is, however, another opportunity of a market afforded by the circumstances of South Essex agriculture.

Almost the whole of south-east Essex is arable, growing corn and straw for London, and fertilized by London dung, often at about the cost of the straw sold. There is, you may say, no stock. It is probable that if grass were supplied to the farmers here they would consume it in yards at home, and send milk or meat to London, making manure for themselves, rather than, at great labour and expense, send straw to London, and cart back the dung. And this, if it could be carried out, would be the best

way of disposing of the produce of the sewaged lands. The grass would be sold, if cheap enough, more easily than the sewage; and if it can be carried for 1d. or 2d. per ton per mile, I believe it can be delivered cheap enough to tempt a trade.

Green food properly consumed is worth 6s. to 9s. a ton to feed upon the land even in ordinary agriculture; near London, with a ready and immediate disposal of milk, it is worth from 15s. up to 20s. a ton. It is hardly possible to doubt either that cowhouses on a large scale, well situated near depôts of grass in a country where there is a great demand for dung, and an ample supply of straw, and where winter food may easily be grown—with ready access, too, to the London milk market, would at once be hired and worked; or that under such circumstances a considerable change in the style of agriculture of the district would gradually grow; more stock would be kept upon the farms, and the London milk trade would extend over the plough lands of South Essex.

Moreover, there is the opportunity offered to the tenants of all such lands as lie near the culvert, to use the sewage on their own lands and grow this grass themselves. I presume it is part of any and every plan of using the 2 or 300,000,000 tons per annum of London sewage to pump it into reservoirs on hill tops or rising ground wherever a local demand for its use occurs. Thence it may be delivered by hydrants or in runnels on the surface of the fields to be watered. I confess my strong preference of the latter to the former plan. There is all the difference between them that exists between labour-needing and self-acting machinery; and while it is of course thus distributed more cheaply, it may be also quite as economical in the use of the material. If I had only 10,000 tons of the stuff per annum to pour over 10 acres on a slope, (and this would, I presume, be thought a reasonable allowance even by those who advocate small dressings), I should prefer pouring it all over the highest acre, letting its tail water reach the others in succession by ordinary surface flow, to an equable distribution over the whole from equidistant hydrants, each of which must be managed by hand, delivering no more at a time than would sink into the land and there be all used. If, however, occasional reservoirs existed whence this sewage could be available in either way in different localities, we might safely leave those who have to make a profit by its use to their own devices as to its management. Anyhow, if by the use of surface irrigation great crops are obtained, and the water at a second or third use is perfectly clarified, then it is plain that the whole attainable result is arrived at; and great expense in hydrants and in detailed distribution will in that case be an expenditure for no useful end.

I believe I have only one additional remark to make, and that hinges on the conclusion here asserted—that if the water leave the land perfectly clarified, the whole attainable result is reached. This will be at once disputed, and is perhaps not absolutely true. In a dry season, no doubt, water, though free from fertilising matter, is itself invaluable, and in a drought it would often pay for pumping and for distribution; but when there is a question of gradually altering the whole style of agriculture of a county, I do not believe in this extra value of the mere water by which enthusiasts, in the advocacy of particular schemes, add on so many additional thousands of pounds to their anticipated receipts.

We have in this country varieties of rainfall amounting to 3,000 and 4,000 tons of water per acre per annum, but the value of the land depends very little upon this. The various styles of agriculture resulting from these differing circumstances do not, as a rule, differ materially in the quantity of rent which is possible under each. That depends on the composition and quality of the land; on the cheapness or abundance of manure, and on the neighbourhood of good markets.

On this subject, however, I must not longer detain you, and I will conclude by naming the results to which this discussion of the subject has hitherto led.

Collecting these nearly into one, although I have not been able to overtake, within the allotted time, all the grounds on which an opinion must be formed, yet the conclusion to which I believe that the agriculturist is led after a study of the subject, is, that grass as the produce and ordinary irrigation as the method—both as involving a minimum of labour—are the proper agents by which the conversion, which we all desire, of London sewage into London milk will most profitably be obtained.

Certainly, on the clay lands of South Essex, to double or quadruple the present annual water supply by a sufficient application of this sewage would be altogether incompatible with anything but grass. On lighter lands with natural drainage, as perhaps ultimately on the Maplin Sands, it may be possible to use the liquid in the growth of mangel-wurzel or potatoes, and to take under arable management one or other of these crops in triennial succession with Italian rye-grass, but elsewhere it must be grass, and only grass, that is capable of sewage treatment.

Another principal conclusion is, that the profitable conversion of the enormous addition to the grass growth of South Essex, which will follow the use of London sewage, can be expected only through a great and therefore necessarily a gradual extension of the London milk trade.

According to Mr. Lawes, we can depend on a ton of grass from every 200 tons or thereabouts of the sewage; and to this agrees the experience at Edinburgh. What if some 200,000,000 tons, taking both north and south London sewage, be annually converted by-and-bye into grass, which, according to the Craigentinny rule, is good for hardly anything but cow food. We should every summer have a million tons of grass to eat—enough for 50,000 cows, in addition to the supplies already grown for the number by which London milk at present is provided.

Lastly, then, as a help out of this—one of the main difficulties which threaten the immediate profitableness of any scheme for using London sewage—I hope that experiments may be instituted as to the possibility of artificial hay making.

It will have been observed that in the course of this paper I have made no reference to Mr. Moule's earth system of dealing with house waste, or to any other of the schemes of dealing with it in detail. The reason is, that I am constrained by the terms in which the subject is announced. The subject is London Sewage, and we are therefore shut up to a discussion of the question—how to use 200,000,000 or 300,000,000 tons of filthy water annually upon the land. That is the problem for consideration; and thus the discussion of methods fit for single houses, or for villages, is excluded.

Again, I have made no reference to the nuisance which may be expected from that agricultural use of this sewage that experience elsewhere seems to have recommended. I believe that the efficacy of the sewage as a manure will be dependent, to some extent, on its being already in a putrifying state; and no doubt a certain nuisance will be created. But if any alarmist here, ready charged with a denunciation of these plans on this account, be about to frighten us all with accounts either of putrid miasma and resultant fevers, or of new parasitic enemies, which through rotten sewage, rank and filthy grass, unhealthy cows and unwholesome milk, are thus to find their home in our bodies, breeding there disease and death, I hope that he and all of us will bear in mind that 400 acres of land, treated more wastefully and filthily than any of the London schemes propose, have been for a century and more under the very noses of the Edinburgh people; who have, moreover, been fed for generations on the milk of the cows which have consumed this sewaged grass. If any evils of the kind alleged are in the least to be expected, they must long ago have shown themselves in the death rate of so large a town; which, how-

ever, I believe, stands as low as that of any in the country. Lastly, it will, of course, be pointed out that I have named one only of the rival schemes for using London sewage. In choosing that one of the number for any particular application of those rules of practice and experience to which I have been calling your attention, I have followed the example of the shrewd and intelligent representatives of London who constitute the Metropolitan Board of Works. They, too, have followed the plans of Messrs. Napier and Hope, as being most worthy of adoption, and they cannot be supposed indifferent either to the general interest of Londoners or to the special interest of those among them who are ratepayers. It is plain, however, that in so far as the experience which has been described sanctions any other of the schemes which have been propounded, most of the remarks which I have made may be quoted by the advocates of those with equal effect.

DISCUSSION.

Mr. HENRY WEBBER said, through the kindness of Dr. Lankester, he was able to bring before the meeting some specimens of the sewage water of London, taken from the Barking outfall. Having been resident in Manchester for thirteen years previous to 1856, and his business (that of a cheese factor) having brought him into communication with farmers, he had seen the most astonishing results from the utilisation of sewage. He might mention one case in particular within his own knowledge, in which the area of grass land was barely sufficient for the maintenance of seventeen cows, the average yield of which was 2½ cwt. of cheese per annum, and the same area of land was, by the application of sewage, made capable of supporting 47 cows, the average yield of which was 3½ cwt. of cheese per annum each. This was sufficient, he thought, to show the great fertilising property of the sewage. Notwithstanding the great practical knowledge of Mr. Morton on this subject, there were some conclusions which that gentleman had drawn with which he (Mr. Webber) could not concur. The proposal to carry the sewage into Essex had been favourably spoken of in the paper, a county which, as the names of many of its towns implied, had only just freed itself from water. It was proposed to carry 100,000,000 gallons of sewage water annually to Ilford, Romford, Chelmsford, and through marshes where the division of land was not by hedges but by water, and by that means to bring that part of the country back again to the state from which it had only just been freed, and which had operated prejudicially upon the productiveness of the land, viz., excessive moisture. The question then arose, in which direction could they beneficially employ this sewage? To that he replied, they had only to cross the Thames and go into the county of Surrey, where they would find a dry parched soil, much better suited for the application of the sewage, which would convert that which was now almost an arid sand into good fertile soil. He had travelled hundreds of miles over the plains of America, and he had not seen anything so sterile there as was to be met with in the neighbourhood of Woking and the Frimley ranges. He believed to take the sewage into Essex would be a failure, and the result of that failure would be to set aside, for centuries, perhaps, any further attempts to give an agricultural value to this product. It should rather be taken where the soil needed it—to the dry and sterile soil of Surrey, where they might look for the very best results from such an application.

Mr. WALKER (of Rugby) said that the extensive pollution of an otherwise beautiful stream in the locality in which he resided induced him, 12 or 13 years ago, to turn his attention to the question of how best to apply the sewage of towns to the land, and from that time to the present he had been more or less occupied in the endeavour to solve this problem, and he had great pleasure in stating that he believed he had at length succeeded in doing so. He had heard all sorts of enthusiasts crying sewage up and others crying it down, both going equally far from the truth, till at length the happy medium, he believed, had been arrived at. But there were some points on which he thought there was still a slight diversity of opinion. Mr. Morton had told them that almost the only way of applying the sewage was by the creation of water meadows. He (Mr. Walker) thought it was probably the best way, but it was by no means the only profitable application of it. In many cases this was undesirable. The object of his experiments at Rugby had been to endeavour to utilise the sewage mainly on pasture land, and, in some measure, upon cereal crops; and he considered what had been done at that place was sufficient to show that sewage could be applied very profitably on good pasture land, without deterioration either to the crops or to the land, and also without producing a nuisance. He thought Mr. Morton had in some measure answered his own arguments on that point, for he had pointed out how difficult it was with the produce of water meadows—only suitable for feeding cows—to obtain a market for the grass if cut, and that was in itself a serious difficulty. For instance, at Rugby, if all the sewage were turned upon the water meadows, the town could not consume the produce of the cows required to feed off the grass, though if it could be artificially converted into hay by the ingenious plan suggested by Mr. Morton, that might remove the difficulty; but at present, however, in small towns it was insuperable under existing arrangements. Therefore, it was of importance to have experiments to show that sewage might be profitably employed on flat pastures, and that he conceived had already been shown at Rugby. Mr. Morton had stated that some of the land there had been completely spoiled. That was quite correct. Land more shamefully spoiled he had never seen than that under the operations of the Royal Sewage Commission. Mr. Morton also mentioned that he had seen other land in the same neighbourhood sewaged and fed off, which was most excellent turf, full of fine grass. That land had to his (Mr. Walker's) knowledge been fed for the last twelve years. There was very little land in fact that had been more continuously watered, but it was not spoilt, because the crop was kept down by feeding; and he maintained, whether it was kept down by the scythe or by the mouths of animals was immaterial; it must, however, be kept down. Directly grass which was watered was allowed to run wild it became coarse, and when the fine grass was destroyed it could not be restored without re-sowing. The great point, then, was, whatever quality of sewage they put upon the land, to take care that the herbage did not run away. It was precisely the same with the trees in a shrubbery. If there were means of stimulating the growth of the trees fivefold, and they were neglected for four or five years, the plantation would become a tangled jungle. So it was with these pastures; and that was the history of the great part of the failure at Rugby. It was obvious that in many towns there were great objections to creating water meadows, which sometimes became, more or less, a nuisance in the neighbourhood; and, therefore, it was, if the system of improving the pastures by moderate watering would be efficacious, that would, in most cases, be the best means of utilising the sewage. The quantity used years ago, however, was far too small to do good. At one time they talked of 5,000 gallons per acre. That was the quantity recommended in the first report of the Board of Health; now they heard of 6,000, 8,000, and 10,000 tons per acre. His impression was, as far as he had seen, that if they mowed or fed the crops carefully they might produce enormous crops with 750 tons per acre spread over five dressings during the year. Supposing, however, they wanted simply to make the most of a given quantity of sewage, if the mode of applying it was necessarily expensive, then they might limit the area and increase the quantity per acre, and, within certain limits, *vice versâ*. Rugby had been constantly mentioned as an instance of failure, and more so lately from the grievous failure in one sense of the ex-

periments of the Royal Commissioners. Four years ago two of his own fields were arranged in plots for experiment; these plots were severally watered in different degrees, one plot not being watered at all. That portion which they watered extravagantly, drowning it at one time and allowing it to become parched up at another, produced very largely at first, but afterwards the grass became very poor. The next plot, which was only less drowned, was slightly less productive, because the parching process had greater prominence; while a third plot, more parched than drowned, produced still less. Such a mode of application was the cause of the want of success of the experiments of the Commission. It was mentioned in the paper that Mr. Campbell, who rented some land of his, had applied a portion of sewage to that land; but the fact was, that gentleman's land all lay so high that he could get only a small proportion of sewage, as the surrounding country was at a lower level. The arrangement for supplying Mr. Campbell was made at the time when it was supposed that a very small quantity of sewage was sufficient; but now it was shown not to be so. He had two other tenants of land who had also declared themselves dissatisfied with the results of sewage irrigation, but in their cases he did not hesitate to say that the failures were occasioned solely by mismanagement. Moreover, when this plan was first commenced, only the sewage proper was allowed to go down the drains of the town; but the pipes were so laid that they very soon became choked, and the surface water of the district was employed to flush the sewers out. The consequence was, in dry weather, these surface drains had no effect. Last summer there was not water enough to keep the pumps at work, and in heavy rains they were drowned out; and with but a small amount of rain there was so great a dilution that the effect of the sewage was very greatly deteriorated. Still he was not less confident than he had ever been that the sewage of towns might be profitably employed to irrigate flat meadows, and he believed also to enrich land for cereal crops. If it was to be done at all, it should be by saturating the ground time after time, allowing it to dry to a reasonable extent before the growing crop was upon it. He would make one other remark with regard to the outfall for London sewage. He thought it to be regretted that the money which was being spent in collecting the sewage at Erith was not spent in erecting a system of steam engines and pipes for collecting it at different points, and making it radiate in various directions—north, east, south, and west; but, as this error had been committed, he thought the scheme for utilising the sewage in Essex was the best thing that could be done with it.

The CHAIRMAN asked, supposing Mr. Walker had to begin the system at Rugby again, what area would he consider sufficient for utilising the sewage of that town?

Mr. WALKER replied he should be disposed to lay pipes nearly to the same extent as he had done already, but they would not be strictly necessary. He could utilise the sewage over a much smaller area, and if the object were to get rid of the sewage, one-tenth of the present area would be quite sufficient for the purpose.

Lord ROBERT MONTAGU, M.P., begged to bear his testimony to the merits of Mr. Morton's paper. He trusted he should not be deemed guilty of presumption in venturing to state a few points on which he differed even from so high an authority on these matters as Mr. Morton. That gentleman, in an early part of his paper, made use of this expression—"I at once confess that the analogy of agricultural experience, both of costs and of returns, leads me to prefer those plans for using London sewage by which it is applied to land in quantity." Now he (Lord R. Montagu) was at a loss to know what those analogies in agricultural experience might be. When they put farm-yard manure upon the land, did they put it on in unlimited quantities? Did they not put it on rather sparingly? Did not the farmer carefully calculate how much manure the extra crops produced would pay for? and no more than than would be put on his land. In like manner, if he used guano, he would carefully regulate the quantity. The rule laid down by Professor Way was that they should only put as much manure on the land as it would readily absorb. The power of land to absorb was extremely limited. If they put more sewage on the land than it could absorb it ran through the land, did not enrich it, but, on the contrary, injured it, and the sewage that ran off entered the streams in the neighbourhood, and the health of the population was thereby endangered. But what was the reason Mr. Lawes gave for putting these large quantities of sewage on the land? He merely did so, he said, to get rid of it—not to get larger crops. The speaker having quoted from Mr. Lawes's evidence on this point, went on to observe that the only reason Mr. Lawes gave for putting this unlimited amount of sewage on the land, was to get rid of the sewage. At Croydon, when they commenced utilising the sewage they began with a small area. They found it occasionally a nuisance; the mud deposited on the land became putrid. They enlarged the area from 56 acres to 100 acres, still it was too small; and they then enlarged it to 260 acres, to which they were restricted by an unfortunate contract they entered into; but they would have been glad to have increased the acreage. Mr. Morton seemed to have been somewhat aware of the mistake he had made in the earlier part of the paper; for he said that Mr. Blackburn, who was the person who employed the sewage at Aldershot, applied only between 200 and 400 tons per acre per annum. If that were good, what must they think of a gentlemen who, in his evidence before the Parliamentary Committee, said he would put on 50,000, 60,000, and even 70,000 tons per acre. That would be equal to a rainfall of the depth of the room in which they were assembled.

The CHAIRMAN remarked that he believed Mr. Blackburn's work had been only recently commenced—three months ago—so that there must be some mistake as to any annual amount he had been said to have applied to the land.

Lord R. MONTAGU—From Mr. Blackburn Mr. Morton passed on to Mr. Walker (of Rugby), who gave excellent evidence before the Committee. It was said that Mr. Walker was dissatisfied because of the injured quality of his land, the alleged deterioration being to the extent of £20 per acre. That truly was the evidence of Mr. Walker with regard to that part of the land over which Mr. Lawes applied the sewage; but a part of the land had remained in his own hands, and that did not pay him; but if he rightly understood the evidence of that gentleman as well as that of others, it was because he had patriotically gone to a large expense in erecting engines and laying down pipes, and by that means diminished his profits. He now came to that portion of the land over which Mr. Lawes had applied the sewage, which was three acres in extent. Mr. Morton said not only was it wrong from the quantity of sewage put on it, but also from the precise rules which were laid down by Mr. Lawes himself, viz., that at such and such times the sewage was to be applied, and at certain precise periods the grass was to be cut. The grass grew long and rank, and rotted at the roots, but Mr. Lawes did not cut it because the prescribed time had not arrived. At last the haymaking time came, and the grass was cut and carted away, while the rotted roots were left to bake in the hot summer sun, the land was parched and cracked, and all the grass worth having was killed. Mr. Morton was perfectly right in saying that he only saw coarse, couchy, weedy stubble of grass. What else could be expected on land at one time drenched with moisture and at another time baked by the heat. Mr. Napier and Mr. Hope stated in their evidence that the Rugby experiment was no criterion at all; and they trusted at least that their own experiment, if ever it was carried out, would be more successful than that of Mr. Lawes. He hoped the same

thing. In another passage of his paper Mr. Morton stated that Mr. Lawes's experiments showed that the crops were increased in direct proportion to the quantity of sewage applied to the land. He would again call to their mind the rule of Professor Way—that they could only successfully apply so much sewage as the earth could absorb, and that which ran away from the land was sheer waste. Professor Way stated further, that the colouring matter in the sewage was due to certain fertilising elements in suspension in it; but so many of these were soluble, that if water apparently pure ran off the land it was no proof that none of them were carried away along with it. If it passed away in a coloured state, *à fortiori*, some of the fertilising elements were carried away. With regard to Rugby, Mr. Lawes stated that the sewage which ran away through the drains was highly coloured. That proved that he put on so much that a great deal of it never reached the roots of the crops at all? The results of the experiment of increasing the quantity of sewage were these:—On the unsewaged land the crop of grass was nine tons per acre; with 3,000 tons of sewage the produce was twenty-two tons; with double that amount of sewage the produce was only one-third more; with 9,000 tons of sewage only one-fifteenth more; which showed that the crop was not increased in proportion to the quantity of sewage applied. It might naturally be asked what was the result with a smaller quantity than 3,000 tons, but this experiment Mr. Lawes had not tried. But there were other witnesses before the committee, such as Mr. Mechi, who used only a small quantity of sewage. Mr. Walker had stated this evening he would not apply, on an average, more than 750 tons per acre; nevertheless Mr. Lawes asserted that he would go even to the extent of 70,000 tons an acre. Mr. Morton had stated that he had not met with any one who was satisfied that the application of sewage to the land was agriculturally profitable. He imagined that sentence of the paper applied to Rugby alone; but he thought they had altogether disposed of Rugby, inasmuch as Mr. Walker stated that the experiments there proved nothing. Mr. Morton had alluded to Edinburgh, but there were a few matters he had left out. The application of the sewage at Edinburgh was described by Mr. Rawlinson, and Professor Way, and he believed by Mr. Hope also, as clumsy and bad, and the waste of manure was enormous. But what were the agricultural advantages even under that acknowledged imperfect method? In the autumn of last year he visited the Craigentinny meadows. The sixth crop had then been cut, and the seventh was on the field knee deep. He was told that formerly that land had let at 2s. 6d. per acre, and was now bringing £40 per acre. Coming back again to Croydon, the sewage of a population of 17,000, amounting to nearly a million gallons per day, used to flow into the Wandle. Numerous actions were brought against the Local Board for the damage thereby done to the stream; amongst other complaints was that of the fish in it being destroyed. No fewer than seven actions and injunctions were tried, at a cost to the Croydon Board of some £10,000. Vice-Chancellor Wood, on the authority of various scientific witnesses, declared that it was necessary to apply the sewage to the land before it should be allowed to flow into the river. Upon this the Board tried the methods of precipitation and deodorising, which had been unsuccessfully adopted at Leicester and Tottenham. Mr. Rawlinson stated that beween the law suits and these attempts at disinfection, the Board expended no less than £24,000; while, he added, the whole of the works for irrigation might have been completed for £20,000. As soon as the sewage was applied to the land the price went up to £4 per acre, and the Board sub-let it to Mr. Marriage for £5 per acre. From the evidence of the Chairman of the Croydon Board, it appeared that Mr. Marriage realised crops of grass on the 260 acres which produced him £32 per acre. He asked were not these instances sufficient to prove the profitable results of the application of sewage to the land? Mr. Morton had alluded to the case of Birmingham, and stated that the sewage was brought into tanks before the supernatant liquid flowed into the river. The soluble parts in this fluid, however, contained six-sevenths of the whole value of the sewage, and this, as stated, was carried away by the river. Mr. Morton had said that the soil was not permanently enriched by sewage, whilst a contrary opinion was entertained by Professor Way.

Mr. MORTON explained that that expression referred only to the sandy slopes of Craigentinny.

Lord R. MONTAGU—One other subject was referred to by Mr. Morton, who stated that the rainfall throughout England was equal to an average of 3,000 to 4,000 tons of water per acre, but that the value of the soil depended very little upon that, but very much on the nature of the soil. The water percolated through light soil till it came to a bed of clay, and it ultimately made its appearance in the valley as a spring; but if it fell on clay soil it remained there till it was either evaporated by the atmosphere or percolated very slowly through the soil. In Huntingdonshire, which was his own district, the farmers complained that the land was overdrained; the water percolated quickly through the gravelly soil and the ground became parched. In the clay land districts the demand was for more deep draining. It was clear from this that sewage when applied to gravelly soils would enrich them; but if it were applied to undrained clay land it only made the evil worse. They already held the rain water, and unless the land were drained, it would only be made cold by the application of sewage water; therefore, the two subjects of the application of sewage and the drainage of heavy lands were intimately connected together. He would conclude by congratulating Mr. Morton upon his able and lucid paper, and by felicitating him also upon his fears that this country would soon be embarassed by a plethora of grass produce and by the consequent enormous amount of milk which would be produced. He thought the inhabitants of London could very well put up with a large supply of pure milk from Essex and other parts of the country.

The CHAIRMAN observed that there were evidently a considerable number of gentlemen present who were desirous to speak on this highly interesting and important subject, and, therefore, if it was agreeable to the meeting, he would suggest that the discussion be adjourned.

The discussion of this subject will be resumed on Wednesday evening next, the 8th February, at 8 o'clock.

MR. THOS. WALKER, of Birmingham, writes as follows:—

Many persons have the idea that the silt, or mud, and other suspended matters (of which there is but one ton in 1,170 tons of sewage) are alone valuable, and that the water is worthless. This is a great mistake. The most valuable manurial matters of the sewage are those held in solution by the water; the dirt being of small comparative value. The fœcal, urinal, vegetable, and animal matters passed into the sewers from water-closets, urinals, slaughterhouses, stables, markets, &c., are, in their passage from the sewers to the outlet, completely deprived of all their soluble portions, by the large volume of water always accompanying them. Let it therefore be well understood that the value of the sewage is in the water alone after the dirt has been taken out of it; as, however much clarified it may be, it will still hold in solution—as sea-water does its salt—all the soluble elements of the decomposed animal and vegetable matters; and only then is it in a fit condition to be used on grass land, as it would otherwise cover the grass with an injurious and offensive deposit and scum, which would close up the pores of the leaves and prevent their taking up atmospheric food. It is then also free from smell; the putrid and undecomposed matters having been all taken out; and, moreover, the solubles, being dissolved in and

incorporated with so much water, will keep sweet and clean for any length of time in the reservoir; besides which, the presence of the dirt would be liable to injure the large pumps, and to lodge in and choke up the carriers. The mud can be taken out, and, by itself, removed to any distance, there to be used as manure for other than grass land. For separating the solid from the fluid matters, years of experience have proved the filtering system to be impracticable, and that a simple settling pit is sufficient, provided that it be made large enough. The method I recommend is as follows:—I pass the sewage, direct from the sewers, into a trough of a certain form, and of a size proportionate to the flow and quality of the sewage; in this trough only the stones, grit, and other heavy matters subside, and from this trough the sewage passes, with its more fibrous suspended matters (through a grating that intercepts rags, paper, &c.), into a large settling pit, capable of containing several hours' flow, and of a convenient construction for facilitating the settling and subsequent emptying of the mud. (It is better to have two of these settling pits, so that the sewage may be depositing its mud in one while the other is being emptied.) In this latter pit the remaining non-decomposed matters are deposited by subsidence, the water passing off clear at its far end to pumping-engines. The pumping-engines, working night and day, will pump the clarified sewage through an underground cast-iron rising main to a large reservoir, capable of holding several days' flow, on any suitable high elevation, from which rising main and the reservoir, any land below can be irrigated by means of branch carriers, which will also be laid below the surface. The distance from the pumps to the reservoir may be several miles. To every 220 yards of the rising main there will be branches, right and left, to which will be attached long carriers, with 6-inch hydrants or taps at every 220 yards. There may be also large service-pipes, starting from the reservoir, in different directions, to be taken through other land where the sewage may be required, in the same manner as described in reference to the rising main and its carriers. As 220 yards square is equal to ten acres, there will, therefore, be a 6-inch hydrant to every ten acres, from which the farmers will (by trenches or otherwise) take their supplies. The farmers situated in any part of the district over which this net-work of carriers extends, will thus be able to have the sewage at any time and anywhere they may require it. The quantity used by each consumer can be ascertained by a water-meter attached to each hydrant, or so much an hour may be charged for each hour that each hydrant is open. The silt or mud is pumped by a diaphragm force-pump from the large pit, through an iron carrier, to any convenient destination. It will be better to have a small separate engine to work the mud-pump, as it will only have to be in action a few days in each month, when the mud is required to be removed; whereas, the Cornish pumping engines, by which the clarified sewage is elevated, will have to be worked night and day. Before concluding, I will make a few remarks on the subject of the Birmingham sewage. The Birmingham Corporation have spent many thousands of pounds in constructing filtering beds and tanks for the detention of the solid or suspended matters of the sewage, not with any view to its utilization, but for the sole purpose of keeping the mud out of the river Tame, as they are under an injunction forbidding them to pass it into that river, into which, however, the valuable clarified sewage is still allowed to flow. The corporation have laid down works for the removal of the mud deposited in the subsiding tanks direct to boats, on a canal about 500 yards away from the tanks, by forcing it through a carrier rising some yards on its way to the boats, by means of the diaphragm pump before referred to, and are sending it to farmers on the banks of the canal for use on their land. Birmingham, from its population of 300,000 inhabitants, produces 12,000,000 gallons of sewage daily, being 40 gallons per head per day, or 20,000,000 tons per annum, which would give 4,000 tons each for 5,000 acres, or 1,000 tons each for 20,000 acres. We find, by the levels of the district, that we should be able to have a summit reservoir not more than 100 feet above the mouth of the sewer below which there is plenty of adjacent land to consume the whole of the sewage, even if it were used over 20,000 acres, the owners of which land would doubtless be willing to pay such a price for it as would amply repay the company supplying it, even if the sewage were sold at very much below its real value. The average value of the fertilising elements held in solution by each ton of town sewage, has been variously estimated by chemists, at from 2d. up to 3½d., taking the price of guano as the standard. This 2d. to 3½d. is without taking into account the irrigating value of the water itself, which latter consideration accounts for the farmers who have used it in light dressings having found it to be worth from 5½d. to 9d. per ton. Now, as 4,000 tons per acre per annum have, in some cases, been applied —although it would be more economical and productive to use it over a larger area, and the cost of plant would be less in proportion—we will take that as our basis to get at an estimate of the cost of works required.

Estimated Cost of raising Sewage.

The average duty of Cornish engines is 56,000,000 lbs. raised one foot high, with one bushel, or 94 lbs., of Welsh coal, the cost of which would be, say 5d., reckoning the coal at 10s. per ton.

As 56,000,000 lbs. are equal to 25,000 tons, we have:—

25,000 tons raised 1 foot for 5d. cost of fuel
or 250 „ 100 „ 5 „
„ 100 „ 100 „ 2 „

The cost of fuel for raising 100 tons 100 feet high would therefore be 2d., which gives £4 11s. 4d. as the daily expense in fuel. If to this be added 2d. per 100 tons for wages, grease, and other incidental expenses, the daily amount of which would likewise be £4 11s. 4d., and is evidently sufficient, the total outlay would be £9 2s. 8d. per day, or £3,333 13s. 4d. per annum, for raising the whole of the Birmingham sewage to the above-mentioned reservoir. Any water-works engineer will verify this statement. The cost would therefore be 4d. for 100 tons, including fuel, wages, and all other working expenses. This gives twenty-five tons for 1d. I have carefully considered the cost of constructing the necessary works for the utilisation of the Birmingham sewage over 5,000 acres of land, and am of opinion that, inclusive of purchase of land, parliamentary expenses, 62½ miles of iron pipes, 500 hydrants (being one to each ten acres), the summit reservoir, Cornish engines, pumps, and other apparatus, the total capital required would not exceed £140,000.

Estimated Value of Sewage per Annum.

20,000,000 tons, even at ½d. per ton, will amount to.....£41,666 13 4

This ½d. per ton is not near the value of the fertilising elements held in solution, exclusive of the irrigating value of the water itself; but I have put the sewage down at ½d., to show that at that low price it would still pay good dividends, even if only two-thirds of it were paid for.

Annual working expenses, including fuel, wages, &c., for raising the whole 20,000,000 of tons to the reservoir, 100 feet high £3,333 13 4

Annual Income and Expenditure.

	£	s.	d.		£	s.	d.
Working expenses....	3,333	13	4	Value of the sewage at ½d. per ton	41,666	13	4
Sinking fund 5 per cent.	7,000	0	0				
Leaving for dividend and office expenses...	31,333	0	0				
	41,666	13	4		41,666	13	4

Proceedings of Institutions.

THE METROPOLITAN DISTRICT.—Mr. H. H. Sales, Visiting Officer of the Society of Arts for the Metropolitan District, writes as follows:—"Since the commencement of the winter season, the work of the Society of Arts, with reference to education, has made great progress in this district. Previously, but few classes, apart from Institutions, had been established for advanced subjects. The standard of attainments in the ordinary night schools was too low to meet the requirements of the Examiners or the Society, even in those schools that attempted to give instruction in other subjects than reading, writing, and arithmetic. In September, classes, on the same plan as that adopted in the City of London College and London Mechanics' Institution, were opened in St. Michael's School-room, Bromley, by Mr. Edmund Hay Currie. The fees paid by the pupils render the classes self-supporting—a most important element as regards their success—and at the same time are sufficient to engage the services of most efficient teachers. The classes of the West London Youths' Institute have been remodelled on a similar plan. In Bethnal-green, self-supporting classes have been established in Abbey-street Schools, and likewise in St. James's Schools, Ratcliffe. A Board of Education for the parish of Islington is in the course of formation, and the organization of classes will form an important part of its operations. The displacement of the common night school by efficiently-conducted, self-supporting special classes, is a marked feature in connection with the progress of adult education in the metropolis. It must not be supposed that the rudiments of education are neglected under this class system. In all these classes an elementary class is included for instruction in reading, writing, and arithmetic, and is generally conducted by a certificated school-master. The Society's system of examinations, certificates, and prizes, gives a collegiate form to the classes, and exerts a great influence upon the students. I regret to say that I cannot bear like testimony to the present scheme of Elementary Examinations conducted by the District Unions. A working man who wishes to study some particular subject, while recognising the wisdom of the Society's regulation respecting a preliminary examination in reading, writing, and arithmetic, cannot see the use of being likewise compelled to study geography and English history; and, consequently in my district the great majority of the candidates who will present themselves in the ensuing Final Examinations will obtain a "pass" from a Local Board, and not a "certificate" from the District Union. Although this action will not affect the Society's Final Examinations, yet it will seriously influence the Elementary Examinations held in connection with it by the Metropolitan District Union. I am strongly of opinion that the Lower Grade Examination should be confined to reading, writing, arithmetic, and dictation; and certificates should be awarded in the Higher Grade for greater proficiency in the same subjects together with elementary grammar and composition, and that geography, English history, and Gospel history should be excluded from the Lower Grade, and not be indispensable for a certificate in the Higher Grade. If the Lower Grade Examination was a stepping stone, as it were, from the day school to the evening class, and the Higher Grade certificate a standard of proficiency in elementary knowledge, I submit that the Elementary Examinations held by the District Unions would then assist in carrying on the education of the day school, and in preparing duly qualified candidates in elementary knowledge for the Final Examinations."

OPERATIVE COACHMAKERS' INDUSTRIAL EXHIBITION.

On Wednesday, the 1st of February, the public opening of the Operative Coachmakers' Industrial Exhibition, in the Coachmakers' Hall, Noble-street, took place in the presence of a large number of persons, the Marquis of LANSDOWNE presiding at the ceremony. The very reverend Dean Milman was also present, and several members of the Coachmakers' Company.

Mr. G. N. HOOPER, of the Haymarket, read an address on behalf of the committee of management, from which the following is extracted:—

"On the occasion of publicly opening the first Industrial Exhibition of the Operative Coachmakers of London, in this corporate hall, every one must feel that a striking contrast is presented between the present state of the coachmaking trade, and the position it occupied when the Company of Coach and Coach-harness Makers received its charter from the hands of King Charles II., May 31st, 1669. At that period trades were mysteries and their processes secret. The present exhibition, however, illustrates a vast change, not only in the processes employed, but in the altered state of feeling on the part of employers and workmen, who now court inquiry, comparison, and inspection of their work, hoping to interest the public by showing how much ingenuity, patience, and care are necessary for the production of a first-rate carriage. Carriages of a rude and uneasy description were invented at a very early date, and were in use among the Israelites, Egyptians, and Assyrians, as recorded in the sacred writings and upon their sculptured monuments. The Greeks and Romans made very little improvement upon the Egyptian carriages, beyond inventing four-wheeled vehicles, and the art seems to have slumbered for many centuries. It revived at length and attained great excellence in Italy in the fifteenth and sixteenth centuries, and became spread over other countries. In the time of Queen Mary, 1556, we find mention made of a coach suspended on leather braces; this may have been sent to her from Italy, by her relations who then ruled over that country. This was the commencement of the improvement in the art of coach building in England, and this art was soon so extensively patronised that the writers of the times foretold that the use of carriages would enervate and enfeeble the people, who ought to be satisfied to travel on horseback as their forefathers had done. We may congratulate ourselves, however, that although carriages are now in daily use by all classes of society, we see no signs of that enervation which our ancestors predicted. Since the introduction of railways, the number of carriages has multiplied to an extraordinary extent, assisted by the reduction of the tax upon them, by Mr. Gladstone, in 1853. This increase, has moreover, stimulated industry and invention. The sound and honest character of English carriages has long been appreciated throughout Europe and every country in the world, and for many years has secured a preference for the English trade. Our carriages have, for upwards of half a century, been considered the best in the world, both in design and durability. The idea of rewarding working men for great skill, as well as master manufacturers, is not new; like many other seeds, destined to bear good fruit, this idea arose during the organising of the Great Exhibition of 1851. It is a matter of regret that we have not been able to promise protection and full security for inventors of new and useful improvements. The patent law, as it at present exists, is both an evil and a good, the dread of exhibiting before the invention is secured often prevents the very exhibition in which hints for perfection might be gathered on one hand, and beneficial sale for the improvement be secured on the other by this sort of publicity. These exhibitions specially offer encouragement for young journeymen to make known their own original ideas by drawings and models; they can thus gain opportunities for advancement and becoming known. Had the committee been able to make the proposed exhibition more generally known, and to have given longer time to prepare objects for exhibition, a much larger number of exhibitors and interesting drawings and models

would probably have been the result; but the near approach to the London season, during which the time and strength of both master and man are taxed to the utmost, forbade any lengthening of the time of preparation, and to defer the exhibition to the autumn might have been to cool down the cordial and expectant feeling that had been raised. It was thought better that a small collection of objects sufficient to fill the hall, containing in itself examples of modern progress, with relics of the past and memorials of true excellence in the art, the whole enshrined in its fitting place of exhibition, the hall of the Company of Coach and Coach-harness Makers, would be better than attempting a more ambitious exhibition."

After an address from the CHAIRMAN,

The Old Hundredth Psalm was sung. The Dean of St. Paul's having offered up a prayer, the Anthem, "Thine, O Lord, is the greatness," was chanted by amateurs, who were coach operatives; and, after "God save the Queen," the Chairman declared the exhibition to be open.

SOUTH LONDON INDUSTRIAL EXHIBITION.

This Exhibition was inaugurated by the Bishop of Winchester, on Wednesday last, at the Lambeth Baths, in presence of a moderately large assemblage. The guarantee fund for the present exhibition is £1,108 5s. 6d., an ample sum for the purpose, and a large number of the guarantors are working men. The prize of £5 for a design for a commemoration medal has been awarded Mr. R. W. Martin, a working man of Walworth. A gallery runs round the walls of the building, and on the front are hung panels recording the various places in the south metropolitan districts from which articles have been collected. There are numerous models of villages and of ships, drawings, paintings in water-colours and in oil, as well as plaster busts and models in terra cotta. The whole exhibition numbers 640 articles of various kinds. The Bishop of Winchester delivered an address, and some hymns were sung.

Fine Arts.

ESTIMATION OF WORKS OF ART.—The tide seems to run just now more strongly in Paris in favour of the work of French artists t han of those of the great masters of Italy and Flanders. Not that any work of any French artist will fetch, even in the Paris market, as much money as a Raphael, a Michael Angelo, a Rubens, or a Murillo, but the relative value of the former is certainly on the rise. At a sale of the works of the sculptor Cordier, a living artist, 58 items realised 59,000 francs (£2,360). The statue of an Arab woman, in onyx and bronze, was purchased by the Duc de Morny for 6,825 francs; a marble statue, called "La Belle Gallinara," seen in London in 1862, if we remember rightly, was sold for 4,100 francs; and two other statues for 3,800 and 3,000 francs respectively.

SALE OF A VENETIAN GLASS.—A most extraordinary instance of growth in the value of an article was exhibited the other day at the sale of the collection of M. Alfred de Knyff, at Brussels. A glass, of Venetian manufacture, which had been purchased but a short time since for one franc, was purchased by a dealer for 1,000 francs.

THE NEW HERCULES.—The Pontifical Academy of Archœology has decided that the colossal statue of Hercules, found beneath the ruins of the Theatre of Pompey, shall be placed in the Vatican, and that it shall bear the title of the *Ercole di Mastai*, in honour of Pius IX. It is a pity that the name by which it is to be known does not rather indicate its origin.

PUBLIC MONUMENTS.—The Emperor of the French has decided that a statue of Dupuytren, the celebrated surgeon, shall be raised in Pierrebuffière, in the department of the Haute-Vienne, the place of his birth. A commission has been appointed, and special application will be made to the learned societies. The Comte de Cardailhac, director of buildings for civil purposes, under the Minister of State, is appointed receiver of the subscriptions and treasurer.—The statues of Cavour and of Italy which are to surmount the monument to be raised in Milan in memory of the great minister of Victor Emmanuel, are now on view at the royal foundry in Florence. The sculptors are Antonio Tantardini and Odoardo Tabacci, and the casting in bronze is entrusted to Clemente Papi.—Four statues were recently set up in the grand vestibule of the Royal University of Naples, representing Pier delle Vigne, Thomas Aquinas, Jourdain Bruno, and John Baptiste Vico. Professor Settembrini seized the occasion to present a plaster bust of Humboldt, from a model by Rauch, and proposed that a subscription should be entered into amongst the professors of the University for its execution in marble. The suggestion was taken up warmly. The sculptor Angelini made a present of a fine block of marble, and a young artist, named Uriele Vitolo, was entrusted with the execution of the work.—A grand monument is about to be raised to Catherine I. in St. Petersburg. A statue of the Empress, which is said to be particularly fine, is to be placed on a pedestal decorated with figures of the following celebrities of the period:—Derjavine, Madame Daschkow, Betski, Bezborodko, Roumiantzow, Potemkin, and Souwarrow. The whole is to be the work of Mikechine, whose original design was to be seen at the London Exhibition of 1862, where a medal was awarded to the artist. Considerable alteration, however, has since been made in the plan and statues. The cost of the whole is estimated at 250,000 roubles.

Manufactures.

AMMONIACAL GAS AS A MOTOR.—M. Ch. Tellier has conceived a new and curious application of this gas. He proposes to take advantage of its peculiar properties, and use it, in certain cases, as a substitute for steam. The qualities referred to are, its great solubility in water, its easy liquefaction, its power of supplying motive power at the ordinary atmospheric temperature, the capability of its vapour being superheated without too great an increase of the temperature, the possibility of re-collecting it by solution, and the faculty of extracting the latent heat from its vapour, after the latter has been employed, and transmitting it to that which is about to be used, by the simple act of dissolving the gas in water. With a given quantity of ammoniacal gas and three times its weight of water, says the inventor, the whole of the former may be vaporized and used as a motive force with a pressure of 8 to 10 atmospheres, and the action would be constant because the latent heat required for the vaporisation would be constantly reproduced by the caloric released by condensation. So that liquid ammonia is said to supply an instantaneous and practical means of obtaining a motive vapour. With about 22 lbs. of the liquid, we are told, the force of one horse may be obtained for an hour. The inventor does not pretend to place this system in competition with the steam-engine, but only where the production of steam would be impracticable and inconvenient. For instance, he says, "an omnibus, drawn by two ammoniacal horses, only need carry about 40 lbs. of liquid ammonia and 120 lbs. weight of water. This would supply a simple motor, without smoke or steam, instantaneous in its action however long and frequent were the stoppages, and with an economy over horses of at least 75 per cent." M. Tellier also recommends his invention for steep inclines on railways, tunnels, mines, and other places where heat cannot be tolerated.

TOBACCO MANUFACTORIES IN FRANCE.—It is well known that the manufacture of tobacco, snuff, and cigars is a State affair in France, as in some other countries. There

are seventeen establishments of the kind in France, two in Paris and one in each of the following towns:—Bordeaux, Châteauroux, Dieppe, Havre, Lille, Lyons, Marseilles, Metz, Morlaix, Nancy, Nantes, Nice, Strasbourg, Tornveins, and Toulouse. The total number of persons employed in these seventeen factories is stated to be nearly 17,000, the two establishments in Paris alone having nearly 3,000. The amount paid for salaries and wages was, in 1862, £335,256, and adding to this the sums paid to agents and others, the total expenses of the tobacco manufacture in France amounted to 11,380,949 francs, or, in round numbers, £455,238.

Obituary.

Mr. J. B. NEILSON, the inventor of the hot blast, died recently. This invention may be said to have revolutionised the iron trade, and added largely to the sources of wealth and happiness throughout the world. The west of Scotland has especially benefited from the stimulus which this invention has given to the development of its mineral treasures during the last 35 years. In 1828, when the hot blast was invented, the produce of the smelting furnaces of Scotland was not more than 29,000 tons per annum; in 1864 the produce was 1,160,000. In 1828 the average selling price of a ton of pig iron was about £7; while in 1864 it was £2 17s. 3d. A large, if not the largest, portion of this increased production and money saving is to be traced more or less directly to the general adoption of the hot blast process. Even before Mr. Neilson's patent expired in 1842, the process had become general in all the iron-producing districts of Europe and America, and was even practised in India. Mr. Neilson was a native of Shettleson, near Glasgow. He was born in 1792, and was brought up as a working mechanic. Mr. Neilson had been twice married, and has left a numerous family.

Notes.

EXHIBITIONS.—The acclimatisation of exhibitions seems to be complete. Shows, artistic and industrial, temporary and permanent, are announced in all directions. Rome is to have a general Exhibition this summer. Cologne announces an international one of agriculture and objects of domestic economy, to open on the 15th of May in this year, in the grounds of the Horticultural and Floral Society, established close to the town, under the patronage of the Queen of Prussia. The Crystal Palace of Oporto is announced to open on the 21st of August; the spot selected for this building is a commanding eminence, from which the Douro may be seen falling into the ocean. On the opposite side is the chapel erected to the memory of King Charles Albert, father of Victor Emmanuel, who died at Oporto. To the east, but at some distance, are the mountains of La Beira, the famous vineyards of Douro, whence comes the Duke of Wellington's second title. Attached to the property of the Exhibition Society is a park, which belongs to the house in which Charles Albert died. The spot selected is about twenty minutes' walk from the town of Oporto, which will shortly be connected, directly, by rail with the Spanish and French lines. The Industrial, Agricultural, and Horticultural Society of the Department of the Haute Marne, announces an Exhibition for the month of May. This department, which is a six hours' journey from Paris, is the centre of the metallurgical industry of the east of France, and, doubtless, the great iron works of Champagne, Lorraine, and Franche-comté will be well represented. The cutlers of Nogent, who have a high reputation, and employ upwards of six thousand workmen, will make a good show. This is not the first Exhibition of the kind that has been held at Chaumont, but it is expected to be on a much larger scale than those which have preceded it. It is said that a company has been formed at Brussels with the view of establishing, at Lacken, a permanent exhibition of objects of industry and works of art. To this may be added the reminder, that Exhibitions of Fine Arts open during the two coming months at Bordeaux, Pau, and Glasgow.

BRITISH ASSOCIATION.—A public meeting was held recently in Dudley, called by the Geological Society, to consider what steps should be taken in South Staffordshire for receiving in a suitable manner the members of the Association at their visit to Birmingham in September next. It was stated at the meeting that one of the most interesting features in the district would be the manufacture of iron, and the geology of Dudley. It would be very desirable that the committee formed in South Staffordshire should prepare a full report on the state of the district iron trade, and on the coal-fields. It was hoped that the district would co-operate in obtaining papers for the various sections bearing on the scientific features of the locality. Mr. Frederick Smith, agent to the Earl of Dudley, announced that his lordship would have every accommodation for the Association on their visit to Dudley; and his grounds, caverns, collieries, and ironworks would be thrown open for their inspection. A committee was formed to make the necessary arrangements for the reception of the Association, and a resolution was passed, requesting the manufacturers of the district to subscribe towards the fund to defray the necessary expenses.

FRENCH ACADEMY OF SCIENCES.—There has been a sharp struggle of parties with respect to the filling the vacant seat in the section of mechanics in the above academy, and a curious departure from the ordinary mode of procedure. Three names were put forward in the usual way, when that of Colonel Favé, the Aide-de-Camp of the Emperor, was proposed, and added to the list by a vote of 31 in a meeting of 58 members, whereupon that of M. Léon Foucault was also proposed and adopted by 36 out of 49 votes. The speech of M. Delaunay, who proposed Colonel Favé in the secret committee, having been printed and distributed by its author, five of the members moved a resolution that the whole of the discussion should be given to the world. It is said that Baron Charles Dupin, M. Combes, and the Generals Piobert and Morin, made a vigorous opposition to the colonel's nomination. The result of all this has been the defeat of that gentleman, and the publication of the fact that he was in reality the representative of his Imperial master. As regards the claims of the two candidates already named, it is said that the discussion has established the fact that the idea of the rifled field artillery was really the Emperor's own, and not that of Colonel Favé, and that the latter was only the author of a faulty sketch for the siege guns used at the Battle of the Alma; and that the plating of ships of war was the work of the commission headed by M. Dupuy de Lôme, the chief constructor of the Imperial Navy, and M. Garnier. The claims of the colonel's opponent, M. Léon Foucault, are well known to the scientific world; his great telescope, and various apparatus for astronomical and other observations, have earned him an European reputation. M. Bertrand and M. Le Verrier supported his claim to the vacant chair, and after several divisions and one adjournment, M. Léon Foucault obtained a majority. Before, however, he takes his seat in the academy, his election will have to be confirmed by the Emperor, to whom all members elect are presented in person by the officers of the academy.

Correspondence.

PROPELLING TRAINS ON LINES WITH FREQUENT STATIONS.—SIR,—My suggestion as to motive power is so evidently misunderstood by your correspondents, that I beg to add some remarks on the subject. The argument of these

gentlemen appears to be that the present average speed (about 14 miles when travelling) cannot be improved without getting too rapidly into motion. I cannot agree to this proposition, but believe that great improvement can be made (certainly up to 20 miles) without undue acceleration and that existing companies will be compelled ultimately by competition to adopt a superior rate of travelling. There is nothing said in my paper to justify the supposition that I propose to put trains suddenly into motion, as the acceleration now made by locomotives in descending gradients, if adopted generally, would make the average above 20 miles per hour. I cannot doubt but that companies having frequent stations, will give due consideration to the subject, and ascertain whether responsible mechanical engineers will lay down and maintain machinery on the plan proposed, and guarantee an improved rate of travelling at reduced cost. —I am, &c., PETER W. BARLOW.

LONDON MUD.—SIR,—London dirt is proverbial, and I have heard countrymen go further, and say that Londoners love dirt; and, having been recently in London, I begin to believe I may say that I skated from Charing-cross to Blackfriars, even by the door of the Society of Arts, and no attempt appeared to be made, except here and there, to remove the accumulated mud. Why is this? Can it not be removed? I believe it can; but if there be a difficulty, pray ask the Council to offer a prize. My own lucubrations, being caught in a heavy shower to-day, teach me that it can be done, and that that very thrifty dame, Nature, shows us how. Well, then, what I would propose is, that we should imitate her. The rain runs from the centre or highest part of the road to the gutter, and from the shop door to the same gutter. Now, if a simple iron pipe, perforated right and left with holes, ran along the centre of the road, and another in front of the doorway or under it, in either case very slightly raised above the road level or pavement, the whole might be very cleanly washed every morning. Further, if the pavement or stones were bedded in asphalte much accumulation of dirt would be avoided, but without this, if duly and persistently washed day by day, the evil would be overcome, and London be as clean and comfortable as the well-washed portion of its population is. Excuse these hasty thoughts of a sufferer, and if possible turn them to account.—I am, &c., ANTIGROPHILOS.

MEETINGS FOR THE ENSUING WEEK.

MON. ...Society of Arts, 8. Cantor Lectures. Professor Ansted, F.R.S., "On the Application of Geology to the Arts and Manufactures." (Lecture I.)
Royal Inst., 2. General Monthly Meeting.
Entomological, 7.
British Architects, 7.
Medical, 8. 1. Dr. E. Symes Thompson, "Notes on Cases of Tumours in the Mediastinum." 2. Mr. Teenan, "On certain Fractures of the Skull."
Asiatic, 3.
R. United Service Inst., 8½. 1. Mr. R. Cail, C E., "Guns, and Cail's Rifled Projectiles." 2. Rev. Andrew A. W. Drew, "Proposed Plan of Building Iron-clad Ships to carry Heavy Guns on the Broadside, with increased Facility of Working them, and Protection for the Crew."
TUES. ...Civil Engineers, 8. Mr. Edward Johnston, "The Chey-Air Bridge, Madras Railway."
Pathological, 8.
Photographic, 8. Annual Meeting.
Ethnological, 8. Prof. Busk, F.R.S., "On Human Remains from Gibraltar."
Royal Inst., 3. Prof. Tyndall, F.R.S., "On Electricity."
WED. ...Society of Arts, 8. Renewed discussion on Mr. Morton's Paper, "On London Sewage from the Agricultural Point of View."
Geological, 8.
Graphic, 8.
Microscopical, 8. Annual Meeting.
Literary Fund, 3.
Archæological Assoc., 8½.
THURS...Royal, 8½.
Antiquaries, 8.
R. Society Club, 6.
Royal Inst., 3. Prof. Tyndall, F.R.S., "On Electricity."
FRI. .....Astronomical, 3. Annual Meeting.
Royal Inst., 8. Mr. W. G. Palgrave, "On Arabia."
SAT. .....Royal Inst., 3. Prof. Marshall, F.R.S., "On the Nervous System."
R. Botanic, 3½.

Patents.

From Commissioners of Patents Journal, January 27th.

GRANTS OF PROVISIONAL PROTECTION.

Atmospheric air, machinery for condensing—96—J. G. Jones.
Atmospherical machine—3143—E. C. M. Bonnier.
Brooch fastenings, &c.—60—J. J. Blackham.
Carbonaceous minerals, treatment of—40—J. E. Vigoulete.
Dredging machine—2621—J. Sourd.
Engraving on crystal, &c.—88—R. A. Brooman.
Fire-arms, breech-loading—3165—T. Woodward.
Fire-arms, breech loading—78—A. and M. Meyer.
Gas, purification of—2883—A. A. Croll.
Guano, treatment of—50—T. Richardson and M. D. Rucker.
Guns, method of operating—3029—W. E. Newton.
Hulling grain, apparatus for—38—G. A. Buchholz.
Iron safes—2485—W. Gardner.
Jacket or protector for metallic vessels, &c.—4—E. Bevan and A. Fleming.
Levels—2987—F. B. Dœring.
Liquids and fluids, heating and evaporating—3131—A. A. L. P. Cochrane.
Match splints, &c., machines for cutting—74—J. C. Brown.
Metallic bedsteads, manufacture of—58—J. Atkins.
Oils and hydrocarbons, treatment of—3252—L. P. E. Max.
Paper board, manufacture of—62—J. F. Jones.
Paper, manufacture of pulp for—80—W. Clark.
Pincers for gas pipes—86—W. E. Gedge.
Pins and hackles, manufacture of—3236—T. R. Harding.
Rails, construction of—3068—S. Truss.
Railway trains, communication between passengers and guard—30—C. Pickworth.
Rice, coffee, &c., apparatus for cleaning—64—J. H. Johnson.
Sewage, &c., utilisation of—3115—W. Bardwell.
Sewing machines—36—A. V. Newton.
Smoke, flues for the consumption of—98—A. Cooper.
Tobacco, manufacture of—68—W. Davies.
Train signalling, apparatus used in—52—E. Tyer.
Vacuum pans—57—E. Beanes and C. W. Finzel.
Vessels, ascertaining the depth of water and speed of—3079—A. Baker.
Washing, &c., machinery for—32—J. W. Branford.
Zinc ores, smelting—46—A. Reynolds.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Mowing and reaping machines—200—W. E. Newton.
Sewing machines—203—A. C. F. Derocquigny and D. Gance.

PATENTS SEALED.

1887. J. Cope.	1971. L. Young.
1890. W. Anderton.	2023. J. Dilkes and E. Turner.
1900. W. Payton and J. Stanley.	2211. C. J. Newbolt.
1901. T. Bourne.	2391. A. Cuthell.
1905. P. H. Moore.	2701. W. Rice.
1906. E. Tattersall.	2746. G. Haseltine.
1907. R. A. Brooman.	2873. G. T. Bousfield.
1924. M. Woodifield.	

From Commissioners of Patents Journal, January 31st.

PATENTS SEALED.

1914. H. T. Davis.	1959. R. Edmondson.
1917. R. Kay, J. Manock, and G. Dakin.	1962. C. Bartley.
	1967. W. Collins & W. Pountney.
1926. E. Brasier.	1977. W. Richards.
1931. C. Garton and T. Hill.	2010. G. Davies.
1938. M. A. Soul.	2025. A. C. Pilliner & J. C. Hill.
1941. F. Cruickshank.	2147. J. H. Johnson.
1942. J. and M. Radcliffe.	2188. W. Clark.
1948. F. J. Bramwell.	2675. A. Parkes.
1950. G. F. Marchisio.	2853. J. P. Nolan.
1952. J. Lee.	2992. J. McIntosh.
1953. I. Farrell.	

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

174. W. H. Ropes.	223. G. H. and E. Morgan.
123. T. and E. Myers.	208. C. W. Harrison.
197. D. Edleston and H. Gledhill.	218. M. A. F. Mennons.
	293. J. L. Norton.
199. J. Wright.	356. W. Wood.

Registered Designs.

Holder for Crochet and Tambour Needles—Jan. 20—4686—J. Shrimpton and Son, Studley, near Redditch.
For Working the Fastenings of Taps, and other like articles—Jan. 27—4687—M. Bermange and Company, 21, Queen-street, City, E.C.
Jelly Strainer—Feb. 1—4688—John Marston, London Works, Bilston.